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ABSTRACT

Designed to improve students' thinking, learning, and creative skills while they learn to program a microcomputer in BASIC programing language, this book for advanced learners at the high school/adult level provides a variety of microcomputer activities designed to extend the concepts learned in the accompanying instructional manuals (volumes 3 and 4). These activities require students to apply those concepts to challenging problems which need original and creative solutions. Each activity includes introductory information; a program to enter, run, and observe; and challenges to change or use the program. Projects include creating or modifying programs that will create and sum random numbers; print all combinations of two letters; calculate the cost of a telegram; produce three- and four-letter words; use a binary counting system; produce a seating chart; convert hexadecimal numbers into decimal numbers and vice versa; save a set of data using a database; display one of six groups of data; accept letters as input but display numbers on the screen; alphabetize groups of words; draw a simple spaceship; display a birthday message; create a personal logo and a fancy title page that allows easy change of the date and the program names; and check ISBN numbers. (LMM)

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THINKING · LEARNING · CREATING

TLC

MICROCOMPUTER PROJECTS

for Growing Minds

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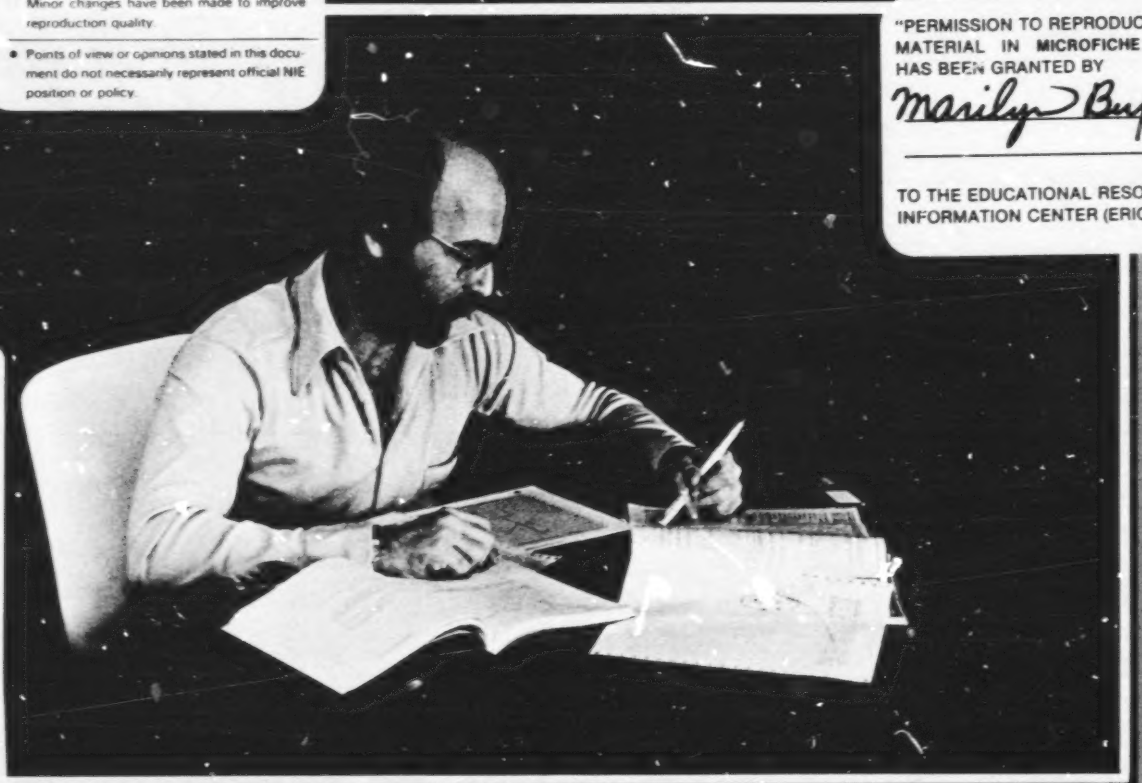

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Advanced Projects for Adults

THINKING · LEARNING · CREATING

TLC

MICROCOMPUTER PROJECTS

for Growing Minds

Advanced Projects for Adults

by Henry A. Taitt

ıtion Resources

CREATIVE LEARNING ASSOCIATION, INC.
RR#4, Box 330
Charleston, Illinois 61920

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Charleston, Illinois 61920

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The projects in this manual are designed to see if you can use the commands you have learned to solve real problems. A complex problem is often solved by considering it to be a collection of smaller interrelated problems, each of which can be solved. Many of the projects here will give you the experience needed to later tackle larger problems.

Remember, there is no answer book. You must evaluate your solution and decide if it solves the CHALLENGE. Be hard on yourself. Do not be in such a rush that you pass over opportunities to learn and improve your skill.

If a program will not RUN without error on your computer, change it so it will RUN.

You are in command! Command well with pride in yourself and your ability.

ENTER/RUN/OBSERVE

```
20 FOR C=1 TO 9
30 FOR T=1 TO X+1
40 PRINT T;
50 NEXT T
60 X=X+1
70 PRINT
80 NEXT C
```

CHALLENGE

Can you alter the program to produce this?

```
1
22
333
4444
333
22
1
```

SUPER CHALLENGE

How about this?

```
   4
  345
 23456
1234567
```

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INFORMATION

Most computers have a way to create RANDOM numbers. But how RANDOM are they?

CHALLENGE

Create a program on your computer that will produce 1ØØØ RANDOM numbers. Each number should be one of the following ten digits.

Ø 1 2 3 4 5 6 7 8 9

Have your program keep a count of how often each number is selected.

Display the results on the screen.
Your display may look something like this:

Ø	1	2	3	4	5	6	7	8	9
11Ø	98	97	1Ø2	95	1Ø1	9Ø	1Ø5	99	1Ø3

Save this program.

Call it RANDOM.

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CHALLENGE

Load your RANDOM program. Change it so that ten RUNS of 1ØØØ numbers each are displayed and summed. Your display may look something like this.

	DIGIT SELECTED									
RUNS	Ø	1	2	3	4	5	6	7	8	9
1	99	101	94	103	97	103	100	102	103	98
2	102	98	97	100	99	102	104	101	98	99
3	98	103	99	97	102	105	97	96	96	107
4	111									
5	95									
6	101									
7	102				-etc.-					
8	98									
9	107									
1Ø	96									
TOTALS	999									

SAVE your program. Name it RANDOM2.

Notice the TOTALS. Was each number selected equally?

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INFORMATION

When you pick up a book and start to read, a rather complex thing starts happening inside your head. Certain combinations of letters mean certain things to you while others mean nothing. You find that when these groups are separated by spaces and sprinkled with marks of punctuation, they can be used to express ideas and feelings.

Using a 26-letter alphabet, there are a fantastic number of possible groupings that could be formed. Since the order is important (RAT is different from TAR which is different from ART) even the number of possible two, three, and four letter words is quite large.

CHALLENGE

Create a program that will print out all possible combinations of two letters. Have your program count the combinations and print out the total at the end.

CHALLENGE

Create a program that will print out and count all possible three letter words, using only A, B, C, and D. No two words can be exactly the same. Each letter can be used only once in a word.

SUPER CHALLENGE

Allow each letter to be used more than once.

Example

AAA

AAB

ABA

BBB

-etc.-

SAVE this program. Name it AAA.

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INFORMATION

When you send a telegram, usually you must pay so much per word.

ENTER/RUN/OBSERVE

```
20 PRINT "TYPE IN YOUR MESSAGE."
25 INPUT X$
30 FOR X=1 TO LEN(X$)
40 IF MID$(X$,X,1)=" " THEN H=H+1
50 NEXT X
70 PRINT "YOUR COST IS $";(H+1)*.2;"."
80 H=0
90 GOTO 20
```

For ATARI, make these changes:

```
10 DIM X$(700)
40 IF X$(X,X)=" " THEN H=H+1
```

For TI, make these changes:

```
 40 IF SEG$(X$,X,1)=" " THEN 100
100 H=H+1
110 GOTO 50
```

CHALLENGE

Change your program to reflect a cost of 10¢ per word plus 1¢ per letter!

INFORMATION

A light switch can either be ON or OFF. If OFF represents zero (Ø) and ON represents one (1) you have a binary counting system.

Notice how you can represent digits from Ø to 9 with a binary system.

LIGHTS	BINARY NUMBERS	BASE 1Ø NUMBERS
oooooooo	Ø	Ø
ooooooo●	1	1
oooooo●o	1Ø	2
oooooo●●	11	3
ooooo●oo	1ØØ	4
ooooo●o●	1Ø1	5
ooooo●●o	11Ø	6
ooooo●●●	111	7
oooo●ooo	1ØØØ	8
oooo●ooo●	1ØØ1	9

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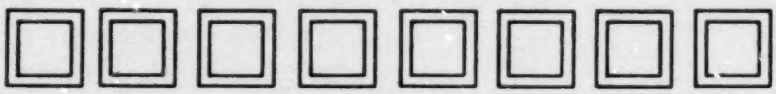
CHALLENGE

Create a subroutine that will display on the screen eight boxes in a row.



Create another subroutine that will allow you to INPUT a number from zero to nine and have the proper boxes change color or light up to represent that number in binary.

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CHALLENGE

Using the 26 letters of the alphabet, create a program that will produce on a printer, all possible three letter words. Have your program count the number of words generated.

How many are words you know? Save your list and this program when you have it working.

Name it THREE.

Notice the following:

T	W	O
W	I	N
O	N	E

L	A	W
A	P	E
W	E	B

A	P	E
P	I	E
E	E	K

W	I	T
I	C	E
T	E	E

Can you create others using only real English words?

CHALLENGE

Now try the same thing with four letter words. Have your program count the number of words produced. Display or get a printout of all those words that start with X.

Take a look at the four letter words that start with X. What percent of them are words that you recognize? What percent are words that you can find in a large English dictionary?

It seems that in general usage, we do not make efficient use of all possible words! However, this might be a useful way to create new words for your adventure games or to name new science fiction creatures!

INFORMATION

Often getting your teacher to change your seat in a class is not easy. . . unless you can produce a seating chart that is fair to everyone.

CHALLENGE

Create a program that will randomly find seats for 2Ø students in a 2Ø seat classroom.

Assign letters to the students (A to T) and numbers to the seats (1 to 2Ø).

RUN your program several times.

SAVE it. Call it SEAT.

CHALLENGE

Change the program to fit your class. Use real student names. Make a printout for your teacher.

INFORMATION

Often to provide social interaction it is nice to alternate the seating in a class by placing a girl next to each boy.

CHALLENGE

Can you alter your SEAT program so that if half the class is male, no two boys sit next to each other?

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INFORMATION

Most microcomputers require hexadecimal numbers to communicate in machine language. This is a base sixteen system. Below is a program that will print out both base ten and base sixteen for the first sixteen numbers.

ENTER/RUN/OBSERVE

```
 5Ø DIM H(16)
 6Ø FOR X=Ø TO 9
 7Ø H(X)=48+X
 8Ø NEXT X
 9Ø FOR X=1Ø TO 15
1ØØ H(X)=X+55
11Ø NEXT X
2ØØ FOR T=Ø TO 15
21Ø IF H=16 THEN I=I+1:H=Ø
22Ø IF I=16 THEN J=J+1:I=Ø
23Ø IF J=16 THEN K=K+1:J=Ø
3ØØ PRINT T,CHR$(H(K));CHR$(H(J));CHR$(H(I))
;CHR$(H(H))
4ØØ H=H+1
45Ø NEXT T
```

For TI, change lines 21Ø, 22Ø, and 23Ø.

Notice in hexadecimal (base sixteen) notation, A=1Ø, B=11, C=12, D=13, E=14, and F=15.

CHANGE IT/RUN/OBSERVE

Change the program to display thirty two numbers. Notice each hexadecimal number.

CHANGE IT/RUN/OBSERVE

Change your program again so that it will continue displaying both decimal and hexadecimal numbers until you stop it.

Notice the hexadecimal numbers for the following decimal numbers.

16
256
4Ø96
65536

Have you noticed that 255 is the limit of many values accepted by your computer? 255 is the

(continued on the next page)

largest number expressible by two digits in hexadecimal. (Example: The value of X in CHR$(X))

65535 is the largest number that can be expressed by four digits. Is that a limit of your computer?

CHALLENGE

Create a program that will accept as INPUT a hexadecimal number and then display its decimal equivalent. SAVE this program when you have it working.

CHALLENGE

Create a program that will accept as INPUT a decimal number and display it on the screen as a hexadecimal number.

INFORMATION

Let's take a look at words from a different point of view. In forming words, are all letters used equally? Do some authors use certain letters and certain words more often than other authors? Do some prefer short words while others like to use longer words? Let's use the computer to find out.

So far we have only been looking at the 26 letters of the alphabet, but in the paragraph above, the space and the apostrophe (') were also found to be quite useful. Commas, periods and question marks were also used.

Perhaps we can ignore the punctuation marks, but we will certainly need to include the spaces.

Withoutthemitwouldbeveryhardtoreadanything.

So let's consider a 27 character set (26 letters

(continued on next page)

and the space) and create a program that will take a passage as DATA and count the number of times each character occurs.

Have your printout show the letter and how many times it occurred. You may wish to distinguish between capitals and lower case letters.

On the next page, you will see a possible way this can be done, but you will have to make several changes so that it will work on your computer.

ENTER/RUN/OBSERVE

```
10 CLEAR 300
20 DIM A(122)
30 READ S$
40 IF VAL(S$)=999 THEN 400
50 L=LEN(S$)
60 FOR M=1 TO L
70 L$=MID$(S$,M,2)
80 N=ASC(L$)
```

(program continued)

```
 90 A(N)=A(N)+1:C=C+1

100 NEXT M

110 GOTO 30

400 FOR P=32 TO 122 STEP 6

405 FOR T=P TO P+5

407 D$=" ":Q$="% %":R$="####"

410 PRINT USING R$;A(T)

412 PRINT USING Q$;D$,CHR$(T),D$

415 IF T=122 THEN 500

420 NEXT T:PRINT

425 NEXT P

500 PRINT:PRINT "TOTAL NUMBER OF SYMBOLS=";C:END

1000 DATA"WHAT LETTERS ARE IN A WORD?"

1010 DATA"Let's take a look at words from a
different point of view."

1015 DATA"In forming words, are all letters used
equally?"

1020 DATA"Do some authors use certain letters
and certain words more often"

1025 DATA"than other authors?"

1030 DATA"Do some prefer short words while others
like to use longer words?"

1035 DATA"Let's use the computer to find out."
```

(program continued)

```
1040 DATA"Thus far we have only been looking at the
26 letters of the alphabet,"

1045 DATA"but in the paragraph above, the spaces
and the apostrophe (') were"

1047 DATA"also found to be quite useful."

1050 DATA"Commas, periods and question marks were
also used."

1060 DATA"Perhaps we can ignore the punctuation
marks, but we will certainly"

1070 DATA"need to include the spaces."

1075 DATA"Withoutthemitwouldbeveryhardtoreadanything."

1080 DATA"So let's consider a 27 character set
(the 26 letters and the space)"

1085 DATA"and create a program that will take a
passage as DATA and count"

1087 DATA"the number of times each character occurs."

1090 DATA"Have your print-out show the letter and
how many times it occurred."

1095 DATA"You may wish to distinguish between
capitals and lower case letters."

1097 DATA"On the next page, you will see a possible
way this can be done,

1100 DATA"but you may have to make several changes
so that it will work"

1107 DATA"on your computer."

1110 DATA"The sample results that will be shown will
come from using this page"
```

(program continued)

```
1115 DATA"as DATA."
1120 "999"
```

The number of counted spaces may vary slightly depending upon how you entered the DATA.

If your computer does not understand PRINT USING, change those lines.

For those with an ATARI, remember what you tried on page 6 to examine each letter of a string.

STOP!

You have finished all the BLUE projects.

NOW!

Before starting on the INDIGO projects, you'll need to learn some new commands from Volume VI of TLC FOR GROWING MINDS. When you have finished Volume VI, come back and sharpen your skills with the INDIGO projects.

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INFORMATION

This first project is to save a set of data that you will use in later projects. The data will be stored in lines 5000 to 5999 and will consist of six groups. The end of each group will be marked by a star (*).

Since different computers may allow a different number of characters per program line, you may need to make some changes in how many words you include with each line number.

When you have entered all of the data, save it under the name DATABANK.

DATABANK

```
5100 DATA KNOWLEDGE, KNOW, DEFINE, MEMORIZE,
REPEAT, RECORD, LIST, RECALL, NAME, RELATE, *
5200 DATA COMPREHENSION, RESTATE, DISCUSS,
DESCRIBE, RECOGNIZE, EXPLAIN, EXPRESS, IDENTIFY,
LOCATE, REPORT, REVIEW, *
```

(continued on next page)

```
5300 DATA  APPLICATION, TRANSLATE, INTERPRET,
APPLY, EMPLOY, USE, DEMONSTRATE, DRAMATIZE,
PRACTICE, ILLUSTRATE, OPERATE, CALCULATE, SHOW,
EXHIBIT, *

5400 DATA  ANALYSIS, ANALYZE, DIFFERENTIATE,
EXPERIMENT, COMPARE, CONTRAST, SCRUTINIZE,
PROBE, INVESTIGATE, DISCOVER, INQUIRE, DETECT,
INSPECT, EXAMINE, SURVEY, DISSECT, *

5500 DATA  SYNTHESIS, COMPOSE, PLAN, PROPOSE,
PRODUCE, INVENT, DEVELOP, DESIGN, FORMULATE,
ARRANGE, ASSEMBLE, COLLECT, CONSTRUCT, CREATE,
SET UP, ORGANIZE, PREPARE, GENERALIZE, ORIGINATE,
PREDICT, CONTRIVE, CONCOCT, SYSTEMATIZE, *

5600 DATA  EVALUATION, JUDGE, DECIDE, APPRAISE,
EVALUATE, RATE, COMPARE, VALUE, REVISE, CONCLUDE,
SELECT, CRITICIZE, ASSESS, MEASURE, ESTIMATE,
INFER, DEDUCE, *
```

CHALLENGE

Load the DATABANK into your computer. Create a program using line numbers less than 5000 that will count the number of stars (*) in the DATABANK.

Add to your program so that it will count how many words are stored as data in the DATABANK.

Add to it once more so that it will count how many letters are used.

CHALLENGE

Using the DATABASE, create a program that will allow you to display on your screen one of the six groups of data. Have a line drawn under the first word.

Example

COMPREHENSION

RESTATE

DISCUSS

DESCRIBE

RECOGNIZE

EXPLAIN

EXPRESS

IDENTIFY

LOCATE

REPORT

REVIEW

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CHALLENGE

Using the DATABASE, create a program that will display the first word from each group.
Add to your program so that you can INPUT a number and then select the word that is in that position from each group.

CHALLENGE

Using the DATABASE, create a program that will select and display all those words that start with the letter C .

Have your program count the number of words selected and print them on a printer. If you do not have the use of a printer, have them displayed in four columns on your screen. Add to your program so that you may INPUT the letter you wish to select.

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CHALLENGE

Using the DATABASE, create a program that will allow you to INPUT the first word in any of the six groups, and the rest of the words in that group will be displayed in alphabetical order. Underline the selected word.

Example

KNOWLEDGE

DEFINE

KNOW

LIST

MEMORIZE

NAME

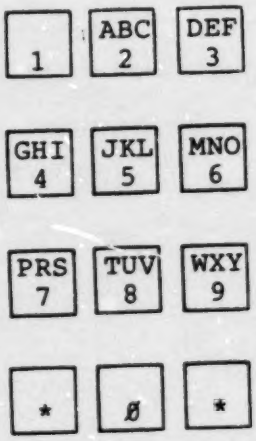
RECORD

RELATE

REPEAT

INFORMATION

On a telephone, you will find both letters and numbers. The system is as follows:



NOTICE that there are no letters with the 1 or Ø. Also notice that Q and Z are not used.

CHALLENGE

Create a program that will accept letters as INPUT but will display numbers on the screen.

Example

Your program 9678 7764726

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CHALLENGE

Create a program that will draw a simple space ship on the screen. Have your space ship randomly appear on the screen but always move horizontally off the screen to the right.

Add a part to your program that will allow you to determine what direction it moves by pressing certain keys.

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CHALLENGE

Using the DATABASE, create a program that will put the words from any group into alphabetical order.

Change the program so that when you enter the first word in any group, your program puts the remaining words in that group into alphabetical order.

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CHALLENGE

Create a program that will check each word in the DATABASE and create a table of how often each letter in the alphabet occurs <u>after</u> the letter E.

EA 3

EB Ø

EC 9

ED 3

EE Ø

-etc.-

CHALLENGE

Create a program that will determine and display how often the following pairs of adjacent letters are found in the DATABASE.

IE

EI

CH

SS

Alter your program to check for other pairs.

SUPER CHALLENGE

Can you alter your program to check all pairs found and count how often each is found?

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INFORMATION

Most microcomputers have some feature that makes them special. It may be high-resolution graphics, shape tables, a music synthesizer, programmable function keys, speech capability, excellent color, special commands, split screen scrolling, extended character set, sprites, or some other trait.

CHALLENGE

Create a program that will display a birthday message. Use the special capabilities of your microcomputer to make it a special program.

CHALLENGE

Using all of the words in the DATABASE, create a program that will display each letter of the alphabet and how many times it was used in the DATABASE.

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CHALLENGE

Using the DATABASE create a program that will display all of the words that contain the word ATE.

Example

RELATE

RESTATE

LOCATE

TRANSLATE

-etc.-

CHALLENGE

Create a program that will select from the DATABASE those words that do not have ATE together and in order, but do have all three letters present.

Example

REPEAT

DRAMATIZE

-etc.-

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INFORMATION

Many programmers create a logo which they include like a coat-of-arms or signature on the things they create. Our logo is the friendly robot TLC.

CHALLENGE

Using your best graphic skills, create a logo that will represent you. Use sound, color, graphics, motion, or whatever your computer does well.

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INFORMATION

Many programs start with a display that acts as a title page announcing the name of the program, the author, and the date it was created. This is often accomplished by sound, color, and graphics whenever possible. It usually also contains the author's logo.

CHALLENGE

Create a fancy title page that will allow you to easily change the date and name of your programs.

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INFORMATION

If you look on the back side of the title page of many books, or on the base of the spine, or on the back of the cover, you often find a series of letters and numbers that begin with ISBN.

It came into being because of the need for a unique number to identify each book, regardless of where in the world it was published. You can imagine how many different books bear the title "Cookbook", or "Dictionary", or even "The Simplified Book of Home Repairs."

This number serves as sort of a fingerprint for the book, allowing a purchaser or librarian to tell one book from another even though the author and title may sound the same.

The system for determining this number is rather interesting, and makes a good computer project.

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The following rules pertain to the number. (This information is taken from "THE ISBN SYSTEM Users' Manual", copyrighted in 1975 by the International ISBN Agency, Berlin.)

1. Every International Standard Book Number (ISBN) consists of ten digits and whenever it is printed it is preceded by the letters ISBN.
2. The ten digit number is divided into four parts of variable length, each part when printed being separated by a hyphen or space.
3. The four parts are as follows:

   Part 1. Group Identifier

   This part identifies the national, geographic or other similar grouping of publishers.

   Part 2. Publisher Identifier

   This part identifies a particular publisher within a group.

(continued on the next page)

Part 3. Title Identifier

This part identifies a particular title or edition of a title published by a particular publisher.

Part 4. Check Digit

This is a single digit at the end of the ISBN which provides an automatic check on the correctness of the ISBN.

The table below gives the range of values that may be assigned as a GROUP IDENTIFIER:

Ø to 7

8Ø to 94

95Ø to 997

998Ø to 99899

999ØØ to 999999

The International ISBN Agency assigns a number within the above ranges, determined by national, geographic, language or other pertinent considerations.

(continued on next page)

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The following table shows the relationship between the PUBLISHER IDENTIFIER and the TITLE IDENTIFIERS.

PUBLISHER IDENTIFIER	TITLE IDENTIFIER
ØØ to 19	1,ØØØ,ØØØ
2ØØ to 699	1ØØ,ØØØ
7,ØØØ to 8,499	1Ø,ØØØ
85,ØØØ to 89,999	1,ØØØ
9ØØ,ØØØ to 949,999	1ØØ
9,5ØØ,ØØØ to 9,999,999	1Ø

The CHECK DIGIT is determined after the above three numbers are assigned. It is determined by a rather interesting method.

Below are several ISBN numbers.

Ø-15-335121-7
Ø-395-24521-4
Ø-534-Ø1265-5
Ø-931988-55-1
Ø-918398-18-5
Ø-Ø7-Ø49156-9
Ø-932760-13-9
Ø-7167-Ø723-3
Ø-918398-1Ø-X
Ø-Ø7-ØØ6745-7

Notice that the GROUP IDENTIFIER for all of them is zero.

Pick out those that have PUBLISHER IDENTIFIER numbers between ØØ and 19. These publishers can publish 1,ØØØ,ØØØ titles! Notice there are several that can publish 1ØØ or less titles.

Assume that the International ISBN Agency has assigned a publisher both a GROUP IDENTIFIER (Ø) and a PUBLISHER IDENTIFIER. (The number for Houghton-Mifflin is 395: the number for Creative Learning is 88193: the number for Prentice Hall, Inc. is 13.)

Now the publisher will assign a TITLE IDENTIFIER from within the range of numbers assigned him. A different number for each and every book he publishes.

At this point the number of digits representing the book must be nine.

The last digit to be added, the CHECK DIGIT, is selected so that when each of the ten digits is multiplied by a digit from 1Ø to 1 and the sum

(continued on next page)

of the products is obtained, it can be divided by 11, with no remainder! It is easier to show than to say!

Example

	ISBN		MULTIPLIERS		PRODUCT
GROUP IDENTIFIER	0	TIMES	10	=	0
PUBLISHER IDENTIFIER	8	TIMES	9	=	72
	4	TIMES	8	=	32
	3	TIMES	7	=	21
	6	TIMES	6	=	36
TITLE IDENTIFIER	1	TIMES	5	=	5
	0	TIMES	4	=	0
	7	TIMES	3	=	21
	2	TIMES	2	=	4
CHECK DIGIT	7	TIMES	1	=	7
		PRODUCT OF THE SUMS			198

198 DIVIDED BY 11 = 18

THUS A CHECK DIGIT OF 7 WORKS

The order of the multipliers always remains the same. The CHECK DIGIT must be selected so that when it is added to the sum of the other products,

(continued on next page)

the total is an exact multiple of eleven!!! The CHECK DIGIT may have values from Ø to 1Ø. If 1Ø is needed, it is expressed as X so that it only takes the space of one digit (modulus 11 arithmetic!).

CHALLENGE

Create a program that will allow as INPUT the GROUP IDENTIFIER and the PUBLISHER IDENTIFIER. Your program should then display all possible TITLE IDENTIFIERS with a proper CHECK DIGIT.

To test your program, use this number:

ISBN # Ø-9876543- -

SUPER CHALLENGE

Create a program that will check any ISBN number that is INPUTed to see if it is a valid number.

Use the number on the back of the book as INPUT.

How many titles is Creative Learning allowed to publish?

If you have reached this page, having solved all the projects in this book, you are an excellent problem solver and programmer.

You are a giant step ahead of most of the people your age. Continue to use your skills and understanding to stay out in front. Continue to improve your skills of learning.

Work towards being the best you can be!

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